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OBSERVATIONS ON STAGNICOLA KINGI (MEEK), LIVING AND EXTINCT

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When R. Ellsworth Call in 1884 described his *Lymnaea utahensis* he undoubtedly had living specimens from Utah Lake, for he lists it among the recent Mollusca of the Bonneville Basin and refers to its dentition as differing "very materially" from that of *Radix ampla*, of which he regarded it as a variety. No subsequent collector, however, has heretofore recorded finding it alive, in spite of repeated searches, and the question has often been raised in recent years as to whether it may not have become wholly extinct. The answer was definitely given several years ago when the writer with a party of students found it still living in numbers in Utah Lake. It has since that time been taken by us whenever desired at the same locality.[1]

This locality is a stretch of shore about a quarter of a mile long on the west side of the lake a short distance south of the promontory locally known as Pelican Point. Here a number of springs empty into the lake, some of these bubbling up through the mud under the water, others arising near or above the water level. The snails were found in the springs and along the currents of fresher water flowing from them, many occurring under submerged or partially submerged rocks. They were not found living except in these places in and adjacent to the springs, indicating that the

[1] More recently we have also taken living specimens of *S. kingi* from Conner's Spring, north of Great Salt Lake, agreeing in all essential features of radula and shells with the Utah Lake form.

lowering of the lake in recent years and the resulting increase in salinity may be the cause of its impending extinction. No unusual difficulty has been experienced in rearing the species from eggs either in balanced aquaria or in those supplied with ordinary tap-water in the laboratory. They thrive on lettuce of which they seem to be fond.

The problem of working out the anatomy and embryology of the species was assigned to two of my graduate students, Elmer Berry and Edward Lowrance, whose reports will appear in due course of time. The anatomy shows agreement with *Stagnicola,* as represented by *S. palustris nuttalliana* (Lea), in the essential generic features of radula, genitalia and other internal parts. As to the specific name, no ground is found for separating the Utah Lake and other recent specimens from the Pliocene species described by Meek as *Lymnaea* (*Polyrhytis*) *kingi* (U. S. Geol. Exploration of the Fortieth Parallel, 1877). Comparisons have been made with topotypes and with a squeeze of Meek's holotype in the National Museum, kindly supplied by Dr. Bartsch, without finding tangible grounds for the separation.

The species has apparently lived continuously in the Utah region since Pliocene times. Specimens taken in Pliocene deposits at various points in Utah and Idaho indicate that the species was widespread and common in the period during which they were laid down in lakes that formerly occupied areas in Cache and Malad valleys and the valley of the Bear River from the region now occupied by Bear Lake along the river into Idaho and back south to the southern end of Gentile Valley and adjacent parts. In Pleistocene times it continued to be a widespread and abundant species throughout the existence of Lake Bonneville, being a characteristic form in the strata deposited in that lake from lowest to uppermost, as well as in smaller lakes apparently existing at the same time. Thus we have it from the finely stratified deposits of a former mountain lake in Mink Creek Canyon, southern Idaho, and in horizontal strata of deltate deposits in the same locality where these rest directly, but unconformably, upon greenish Pliocene shales. It was found

similarly in mountain lake deposits. In Logan Canyon where these had been exposed by a cut made in the course of road construction to a depth of from sixty to a hundred feet below the upper surface and in similar deposits elsewhere. The species is present in the deltate deposits of Lake Bonneville, e.g., in the Salt Lake Valley, Malad Valley and Cache Valley. It is present in the deposits of the Salt Lake Valley itself in its more central area down to a depth of over seven hundred feet from the surface as shown by shells imbedded in cores of borings brought up from accurately determined levels in the course of drillings made by an oil company. This material, so far as separated, is in the Zoological Museum of the University of Utah. In the more superficial strata up to within a foot of the surface *S. kingi* occurs in large numbers, being commonly the most abundant form; while it is extremely common over the Sevier desert, lying on the surface over wide areas remote from the mountains and, therefore, never covered by detrital fill since the recession of the waters of Bonneville. It is similarly common in the deeper deposits of this region where these have been exposed in cuts made by the Sevier River.

In the facts available there seems to be nothing to support the suggestion made by Dall (1905) that the ribbing in *kingi,* whatever may be the case in other costate forms, is due to a progressive increase in the alkalinity of water due to evaporation and accordingly becomes more marked as we ascend the beds deposited in Pliocene and Pleistocene lakes. Speaking of the species under discussion Dall says: "It is to be borne in mind that the plications which led Meek to propose a genus for his species are pathological and not specific characters. They are directly due to the increase in the alkaline salts in the water inhabited by the mollusks and have been imposed upon various gastropods in the same situation." And again: "While such changes are the result of the direct action of the environment, and are not hereditary or evolutionary, it is, nevertheless, convenient to recognize the results in the systematic arrangement of the species."

The fact is that in the case of *S. kingi,* the largest percent-

age of strongly ribbed shells has been found in Pliocene specimens and those of probably very early Pleistocene age, such as those sifted out so abundantly on the shores of Bear Lake, the percentage of such shells decreasing in a general way, in line with Call's observations on other forms, such as *Pompholyx* (*Parapholyx*) in the Lahontan region, in more recent deposits, although conspicuously ribbed individuals are found among the living representatives of Utah Lake. The specimens from former mountain lakes show the characteristic ribbing in the usual varying degrees. Furthermore, this is also the case with specimens reared from eggs in aquaria, even where the shells are extremely thin and translucent from lack of appropriate mineral matter in the water. Such facts indicate that the ribbing is not "pathological" and due to the direct action of the environment, but that it is a truly genetic character, valid in specific definition. Upon this matter it is my expectation to present definite experimental evidence at another time.

DISTRIBUTION OF GASTROPODS IN THE MUDDY RIVER—SEPTEMBER, 1932

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Casual captures of gastropods in the Muddy River (Boston, Mass.) over several years have indicated that some marked changes have occurred in the past year or two, so I have explored the whole length of it (about 3¾ miles) for a few conspicuous forms, of which I wish to put the distribution on record. In the following list the distances given are in miles from the mouth of the Muddy River, measured in midstream.

Viciparus contectoides. Six taken at .55 mi. (immediately north of Agassiz Road). Mr. W. J. Clench tells me this is a new introduction in the Muddy River.

Viviparus malleatus. From 1.4 to 3.0 mi., most abundant about 2 mi. up.